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(54) **Apparatus and method for making books**

(57) Apparatus for making a book by gluing together sheets (32, Fig. 3) in register comprises means 6 for applying glue, a frame 20 for receiving and stacking the sheets after gluing, and means 2, 4 for transporting the sheets to the gluing means 6 and into the frame 20. The frame 20 is internally dimensioned to be a close fit for the sheets (32, Fig. 3), and the frame 20 is provided with means 12 for knocking the sheets towards an end stop 18 as they fall in the frame 20 to ensure even stacking. A method for using the apparatus is also disclosed.

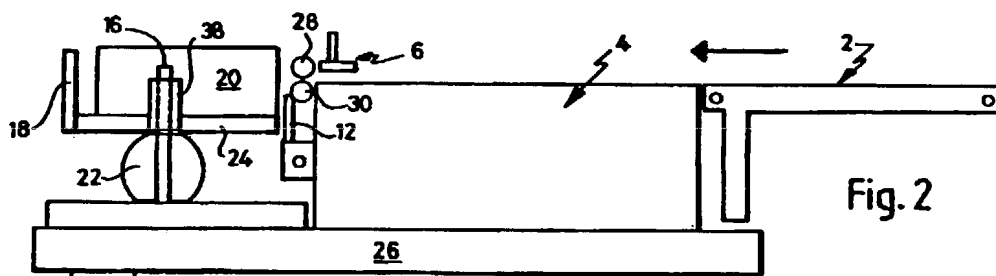
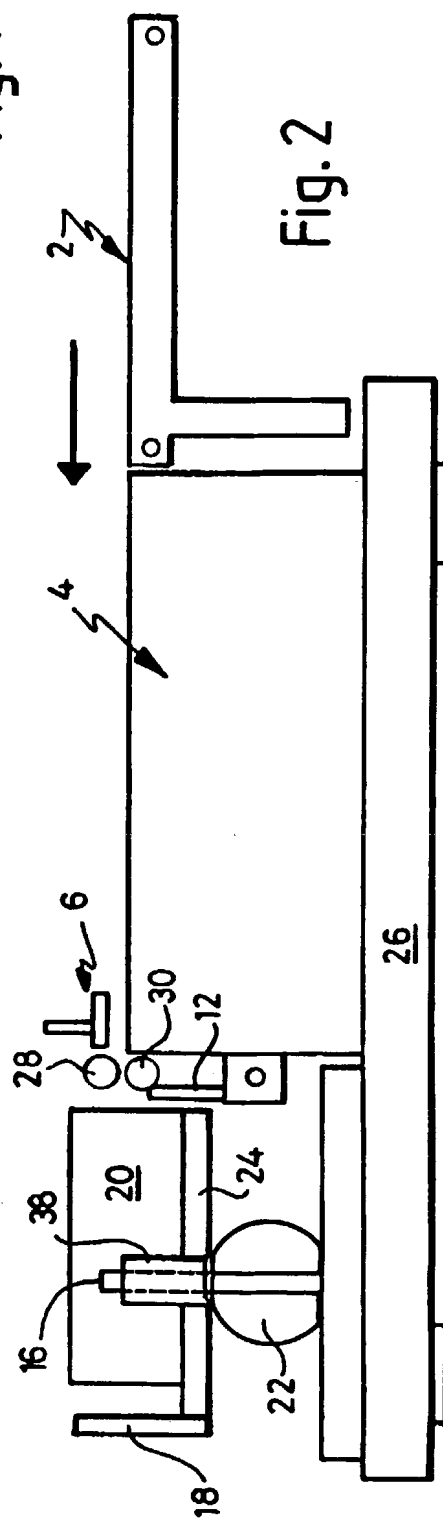
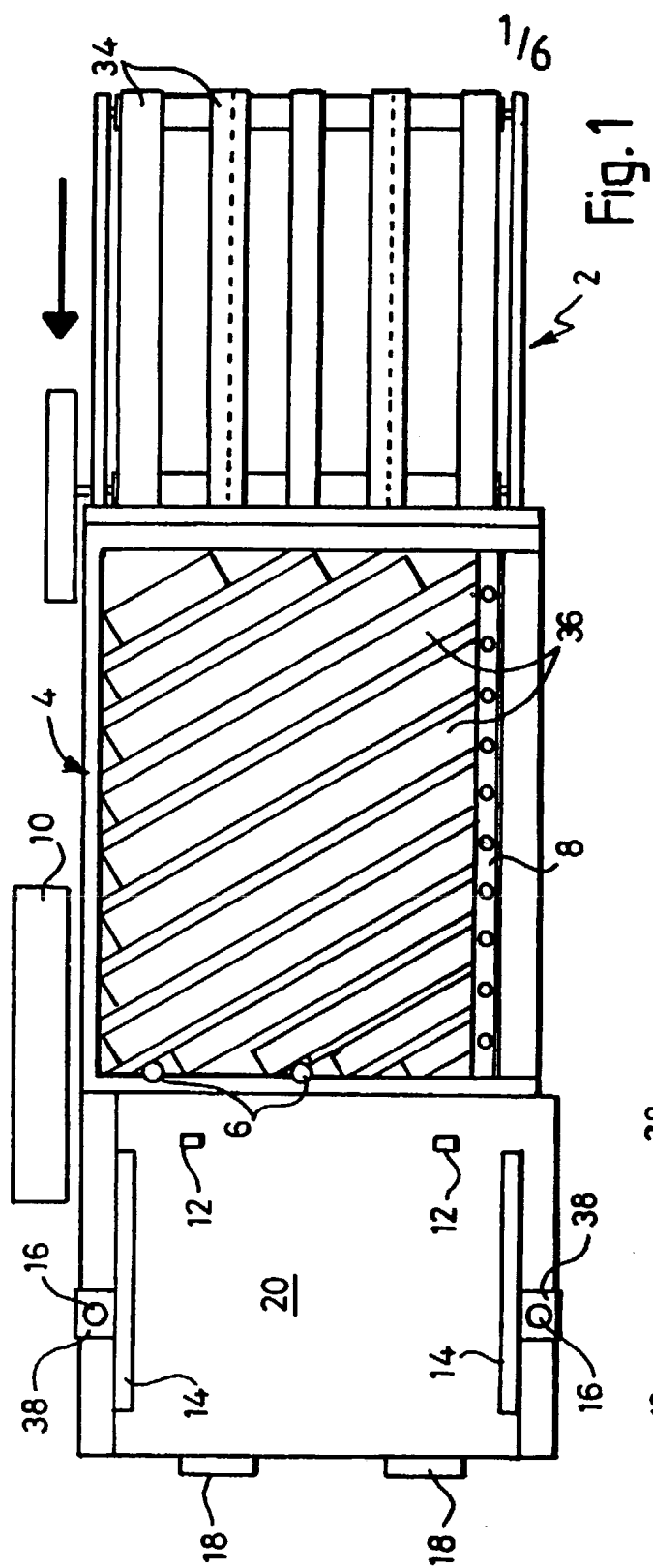


Fig. 2

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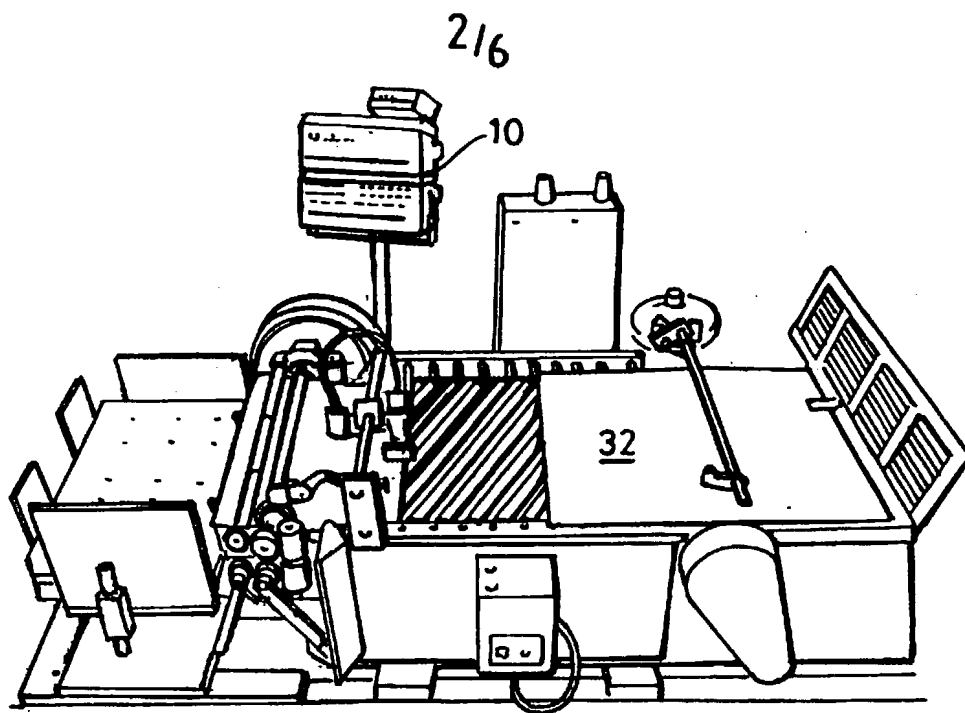


Fig. 3

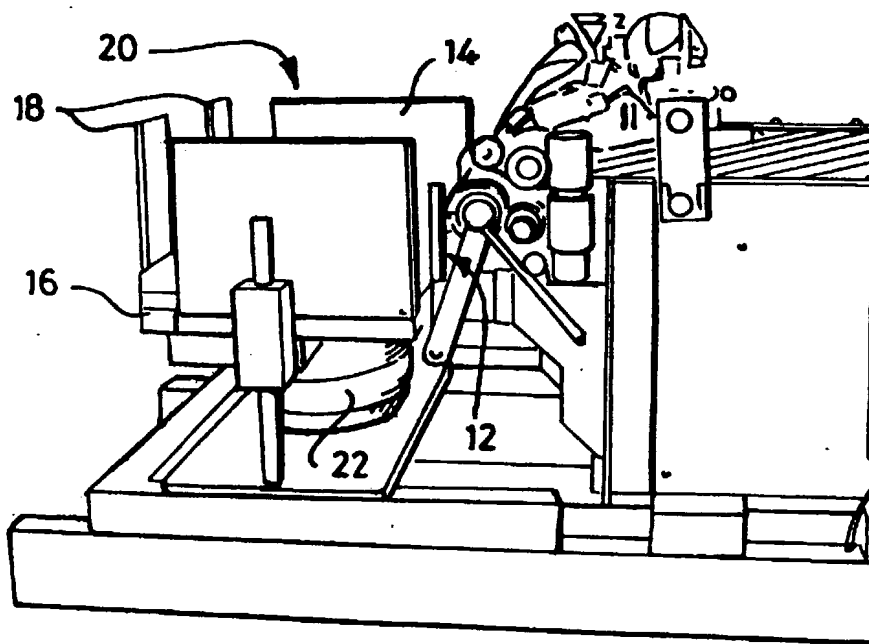


Fig. 4

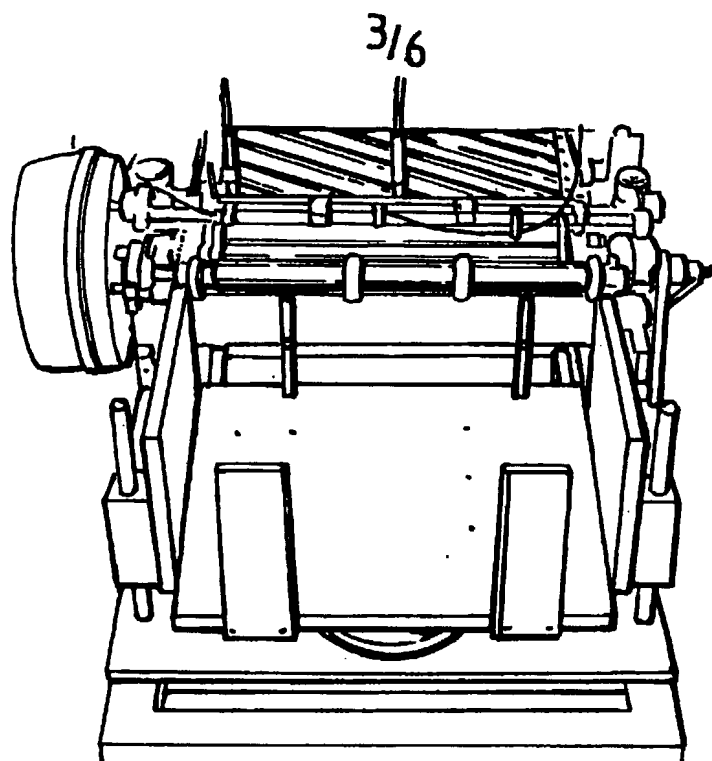


Fig. 5

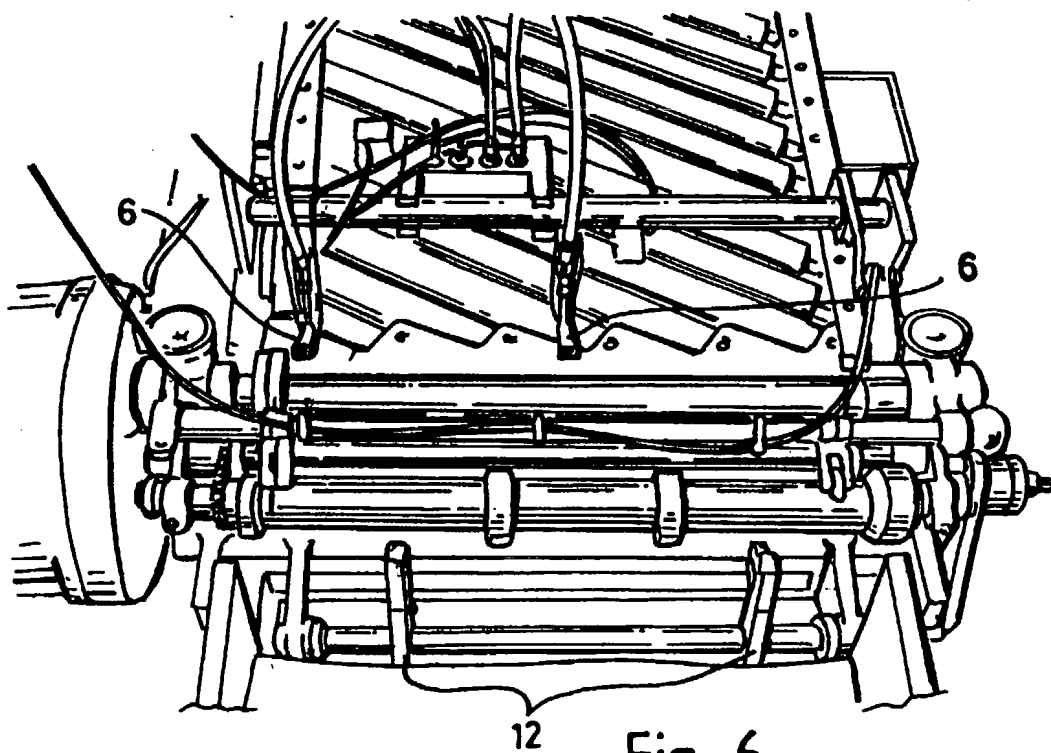
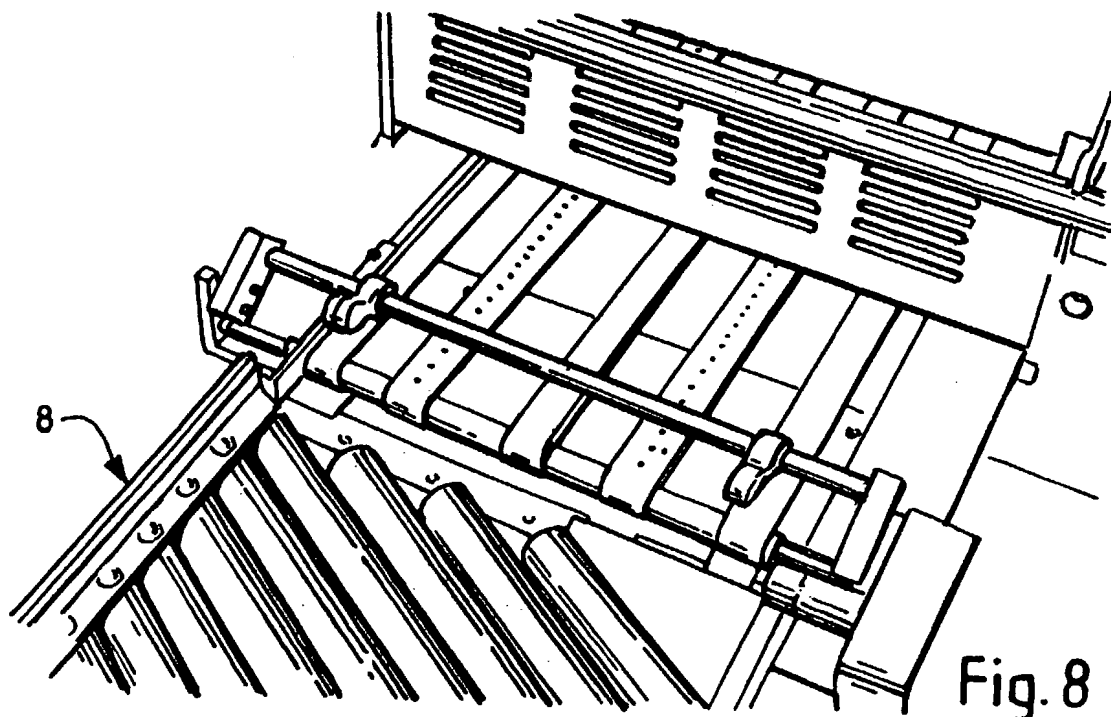
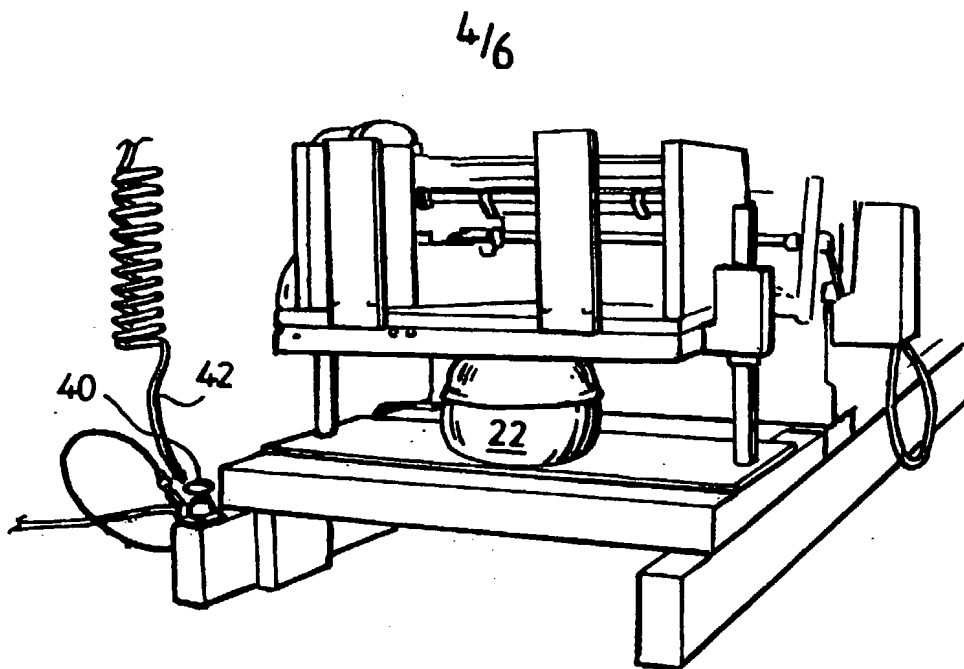
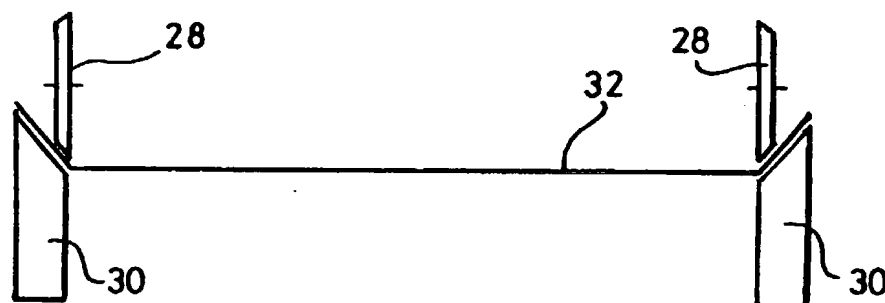
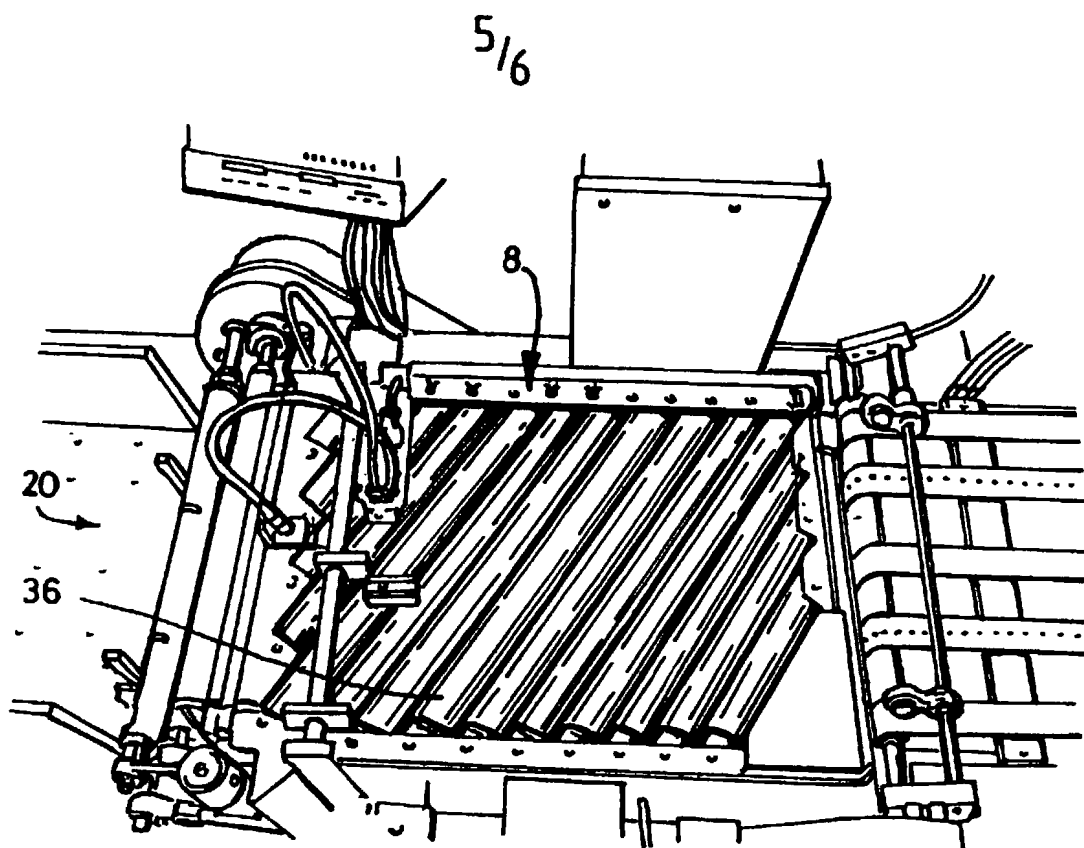


Fig. 6





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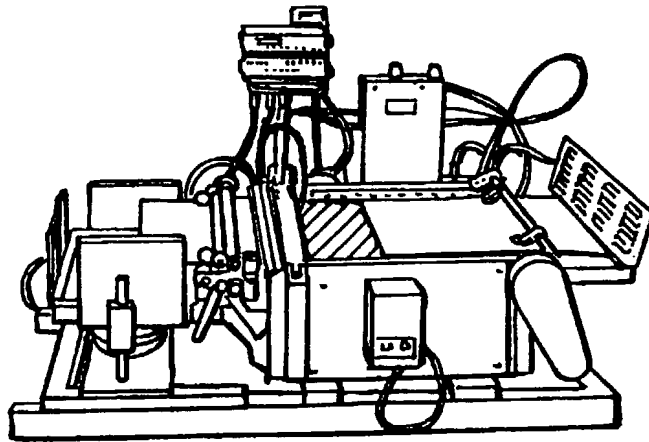


Fig. 10

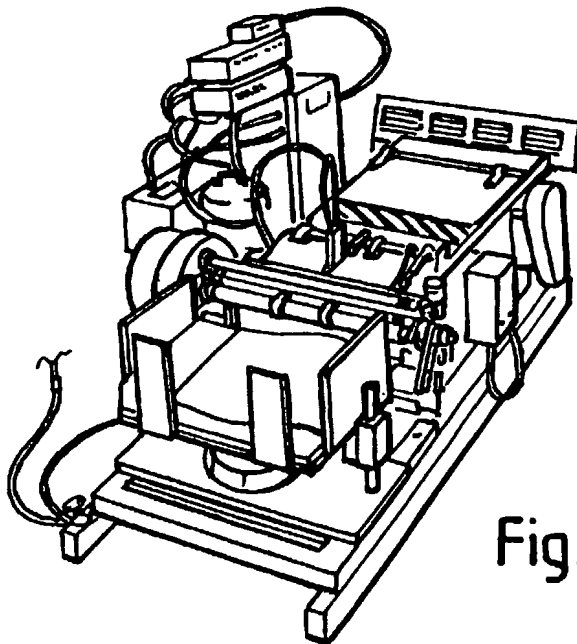


Fig. 11

METHOD AND APPARATUS

The present invention relates to a method and apparatus for assembling books or booklets. The invention is of particular use in assembling books of tickets, for example draw tickets, as they come off a press.

Books of individually numbered draw tickets are conventionally assembled by gluing or stapling together separate printed sheets. Each sheet typically has a plurality of tickets printed on it, for example six or eight tickets. After stapling, or after the glue has dried, each stack of sheets is guillotined to produce the books of tickets.

Gluing is preferable to stapling for cost reasons, and because stray staples can foul the manufacturing machinery. Staples can also cause cuts to the fingers when a ticket is separated from the book.

A problem with gluing is that relative movement between the sheets before the glue has dried will cause misalignment and lead to an unacceptable product. Such relative movement is particularly liable to occur when glued sheets are stacked together.

A further problem is that the top sheet of each stack that is to become a book must either be free from glue, or no subsequent sheet must be placed on top of that stack while the glue is wet, causing storage problems because of the need to avoid placing one stack on top of another.

For convenience the term "book" will be used herein to include any bound collection of sheets. The term includes booklets, fascicles and the like.

According to the present invention there is provided a method of manufacturing a book from a plurality of printed sheets, which method comprises:

- 5 a) transporting each sheet to a glue applicator;
- b) aligning each sheet in register with an opening of a frame for receiving and stacking the sheets, the frame having at least one end stop for checking the forward movement of the sheets, and the frame being
10 selected to be internally dimensioned so that each sheet is a close fit inside the frame when aligned generally horizontally;
- c) applying glue to at least one pre-selected area of the top surface of each sheet except the sheet that
15 is to be the front sheet of the book;
- d) transporting each sheet through the opening and into the frame; and
- e) knocking sheets in the frame towards the end stop as they fall so that the sheets stack in register with
20 one another.

By making the frame a close internal fit for the sheets, and knocking the sheets towards the end stop as they fall, each sheet may be made to descend on a cushion of air to
25 form a stack of sheets in register with each other.

After drying, each stack may then be removed from the frame. If a stack is to provide more than one book, it may be guillotined in a conventional manner after drying.

30

The invention also provides apparatus for manufacturing a book from a plurality of sheets, which apparatus comprises:

- a) means for applying glue to at least one pre-selected area of the top surface of a sheet;
- b) a frame for receiving and stacking the sheets, the frame having an opening through which a sheet may enter, and at least one end stop for checking the forward movement of the sheets, the frame being internally dimensioned so that each sheet is a close fit inside the frame when aligned generally horizontally;
- 10 c) means for transporting each sheet to the glue applicator;
- d) means for aligning each sheet in register with the opening of the frame;
- e) means for transporting each sheet from the glue applicator through the opening and into the frame;
- 15 and
- f) means for knocking the sheets towards the end stop as they fall in the frame so that the sheets stack in register with one another.

20

If each sheet is naturally sufficiently stiff, it will lie in a generally horizontal plane when transported into the frame. However, if the sheets are naturally flexible it may be necessary to process each sheet to increase its resistance to bending. This may be achieved by folding one or both edges of the sheet in a direction parallel to the direction of travel of the sheet. It is preferred that such folds are made in borders of the sheet which are intended subsequently to be cropped and removed.

30

The folds are preferably induced after gluing, as the sheet is transported into the frame. The folds may be induced by any suitable folding means; for example by crimping each edge of the sheet between a pressurised

wheel and a rest having a bevelled surface so as to induce an upward edge fold.

5 It is preferred that the frame is lowered relative to the transport means so that the distance through which the sheets fall remains substantially constant as the frame fills up with stacked sheets. This helps ensure uniform stacking, and that each sheet drops onto the stack at the same speed.

10

In a preferred embodiment the frame is mounted on one or more vertical rods or poles and supported from underneath by an air bag. The frame may be made to descend at a steady speed by controlled release of air through an air bleed. Alternatively the frame may be lowered by an electric or other motor.

15 The frame has a floor for supporting the stack of sheets, and a pair of side walls. Each side wall has an internal surface aligned in a generally vertical plane parallel to the direction of transport of the sheets into the frame.

20 The frame has an end stop or wall which functions as a stop to arrest further movement of the sheets in the direction of transport.

25 The end stop need not be continuous in construction and may comprise, for example, a pair of vertical fingers. There is preferably a gap between the end stop and each side wall to allow access to the front corners of the stacks for manual removal of the stacks after they have dried sufficiently to be handled.

30 The distance between the side walls may be adjustable, and the distance of the end stop from the opening may be

adjustable, to allow the dimensions of the frame to be altered to provide a close fit for different sizes of sheets. Alternatively, a plurality of different sized frames may be used, each frame being internally
5 dimensioned to receive a preferred size of paper.

The sheets are preferably knocked towards the end stop by one or more motorised joggers located below the opening, and which oscillate so as to knock the sheets as they fall
10 in the frame.

In a preferred embodiment, the glue is dispensed through non-contact glue guns, under air pressure. An air pressurising unit may supply the pressure for the glue
15 guns and the pressure to inflate the air bag.

Non-contact glue guns are preferred because the application of glue does not obstruct the smooth passage of the sheets. There may also be less deposit of dried
20 glue at the point of application.

Other types of glue applicators may also be used, however, including contact gluing nozzles. For convenience hereinafter the invention will be described with reference
25 to non-contact glue guns, although it is to be understood that the invention is not limited to this embodiment.

The glue guns may be fired in response to signals generated by an optical sensor which detects the leading
30 edge of each sheet as it approaches the gluing station. The guns may fire a continuous glue line, or a series of dots, dashes, or other desired patterns.

The optical sensor signals may be fed into a programmable
35 controller which may be pre-programmed with the number of

5 sheets which will make up each book. The sheets will be transported to the gluing station in reverse order, with the front sheet last. The controller will inhibit firing of the glue guns every n sheets, where n is the number of sheets in the book, so that adjacent books in a stack do not adhere to each other.

10 The sheets may be transported to the gluing station and aligned by conventional means. For example a set of angled rollers and a side lay bar may be used, preferably fed from a conveyor belt. The conveyor belt is preferably provided with vacuum hold-down means.

15 The invention is particularly intended for use with a printing press, so that sheets which exit the printing press are then transported to the gluing station and into the frame.

20 Where sheets are held in a gripper as they exit from the press, it is important to regulate the speed of the conveyor belt so that the gripper travels faster than the belt. This ensures that the vacuum on the conveyor belt holds down the back of a sheet while the gripper releases the front end. If the belt were to move faster than the gripper, bunching would occur, with sheets being pushed
25 against the gripper before being released.

30 A blower mounted on the press may optionally be used to aid fall of the sheets. The air for the blower is preferably provided by the same pump which produces the vacuum hold-down.

35 The invention will now be further described, by way of example, with reference to the following drawing in which:

Figure 1 is a top view of apparatus in accordance with one aspect of the present invention;

5 Figure 2 is a side view of the apparatus shown in Figure 1;

10 Figure 3 is a perspective side view of the apparatus shown in Figures 1 and 2, with a different roller drive arrangement;

Figures 4 to 9 are perspective views which show more details of the apparatus shown in Figure 3;

15 Figures 10 and 11 are perspective views of the apparatus of Figures 3 to 9 in operation; and

Figure 12 is a schematic view of the folding of a sheet in accordance with one aspect of the invention.

20 Figures 1 and 2 show apparatus for manufacturing a book from a plurality of sheets. The apparatus comprises a frame 20, a pair of glue guns 6, a conveyor 2 for receiving sheets from a printing press (not shown), and an angled roller drive 4 for transporting sheets to the glue
25 guns 6 and into the frame 20. The apparatus is releasably mounted on a moveable chassis 26.

The conveyor 2 comprises five separate endless belts 34. Two of the belts 34 are provided with punched holes (shown
30 as dotted lines) and connected to vacuum pumps to hold individual sheets tightly while the sheets are on the conveyor 2.

35 Sheets of paper are deposited on the conveyor 2 at regular intervals from the press. The sheets arrive in a shingle,

by means of a delivery gripper. The delivery gripper travels at a greater speed than the conveyor so the vacuum on the conveyor holds the back end of the sheet, allowing the gripper to release the front end of the sheet without
5 bunching of the shingle. A blower mounted on the press aids the fall of the sheets. The air for this is supplied by the pump which forms the vacuum.

The apparatus may be used with many different types of
10 printing press. We have optimised the example apparatus for use particularly with a Heidelberg GTO (Trade Mark) single or multi colour machine.

The speed of running of the apparatus will be linked to
15 the speed at which the press is running. We have run the apparatus satisfactorily with a press output of 5000 to 6000 sheets per hour, and a conveyor belt speed of around 0.42 m/s. These figures are given by way of illustration and do not limit the invention in any way.

20 The rollers 36 of the angled roller drive 4 are driven faster than the conveyor belts 34. The roller drive 4, best shown in Figures 8 and 9, has a side lay and ball track 8 along one side, for aligning sheets correctly for
25 gluing and transport into the frame 20. When the shingle reaches the roller drive 4, the leading sheet is accelerated away from the shingle and brought into alignment with the side lay 8.

30 Figures 3 to 11 show similar apparatus to Figures 1 and 2, but with the angled roller drive 4 arranged to align sheets 32 on the opposite side. It will be appreciated that the principle of operation is identical.

The passage of sheets along the apparatus is generally best appreciated from Figures 10 and 11.

5 As a sheet 32 approaches the glue guns 6, an optical detector (not shown) detects the passage of the leading edge of the sheet 32 and sends a signal to an electronic controller 10. The controller 10 is pre-programmed with the number of sheets which are to form a book. The controller 10 causes the glue guns 6 to apply glue to the
10 sheet 32 as it passes, unless that sheet 32 is to be the front page of the book, when glue application is not required and no signal is sent by the controller 10.

15 As the sheet 32 passes the glue guns 6 it is fed between a pressurised roller 28 and a rest 30. As shown in Figure 12, the roller 28 and rest 30 have complementary bevelled surfaces which cause the sheet 32 to fold or corrugate along each edge, parallel to the direction of travel. The folds are greatly exaggerated in Figure 12 for clarity.
20 The folds are made in regions of the sheets 32 which will later be guillotined as the glued stacks of sheets are converted into the books.

25 The folds help to make the sheets sufficiently stiff to resist bending when they pass through an opening into the frame 20. The frame 20 comprises a floor 24 for supporting a stack of sheets 32, a pair of side walls 14, and a pair of end stops 18. The side walls 14 and the end stops 18 are rigidly connected to the floor and internally
30 dimensioned so that the sheets 32 are a close fit when the sheets are generally horizontal.

The folding of the sheets 32 aids entry into the frame 20, and help to ensure the sheets 32 stay generally horizontal

as they drop. However the folds need not be permanent, and the sheets 32 may flatten out as they stack.

5 The frame 20, shown from one side in Figure 4 and from one end in Figure 5, is slidably mounted on a pair of metal rods 16 by means of a pair of sleeves 38 on the side walls 14. The frame 20 is constructed of 50 mm box section steel, and the rods 16 are of 25 mm diameter steel.

10 The frame 20 is supported on an airbag or bladder 22, best seen in Figures 4 and 7, located in a dish under the centre of the floor 24. The frame 20 may be raised or lowered by inflating or deflating the airbag 22. We have found that a plastic football works well as an airbag 22.

15 As sheets 32 stack in the frame 20, the frame 20 is steadily lowered by the release of air from the airbag 20. The rate of fall is regulated by leakage controlled by an air flow regulator from a feed pipe to the airbag 22. To
20 raise the frame 20 the airbag 22 is inflated by a foot operated valve 40 from an air line 42, as shown in Figure 7.

25 A pair of motorised oscillating fingers 12, best seen in Figure 6, are located adjacent to the frame 20, and these act as joggers to knock the sheets 32 as they fall to keep the sheets 32 up against the end stops 18 and ensure even stacking. The fingers 12 effectively funnel the sheets 32
30 into the stack in the correct registration. Without the oscillating fingers 12 each sheet 32 would tend to rebound from the end stop 18 and would not stack in close register.

The enclosed sides walls 14 aid even stacking by helping
35 retain air between the sheets 32 as they fall.

The sheets 32 stack in register in the frame 20, to form a book with sheets in good registration ready for guillotining if desired. Gaps between the end stops 18 and the side walls 14 allow easy manual removal of the
5 stacks of sheets from the frame 20. Typically the height of a stack before removal is a maximum of 120 mm, or around 1000 sheets of paper for draw tickets.

The above apparatus has been described by way of example
10 of one embodiment of the invention. The invention is not limited to the embodiment described, and it is to be understood that many alternative embodiments are possible within the scope of the invention as defined by the claims.

CLAIMS

1. A method of manufacturing a book from a plurality of printed sheets, which method comprises:

5

- a) transporting each sheet to a glue applicator;
- b) aligning each sheet in register with an opening of a frame for receiving and stacking the sheets, the frame having at least one end stop for checking the forward movement of the sheets, and the frame being selected to be internally dimensioned so that each sheet is a close fit inside the frame when aligned generally horizontally;
- c) applying glue to at least one pre-selected area of the top surface of each sheet except the sheet that is to be the front sheet of the book;
- d) transporting each sheet through the opening and into the frame; and
- e) knocking sheets in the frame towards the end stop as they fall so that the sheets stack in register with one another.

10

15

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2. A method as claimed in Claim 1, further including the step of making at least one fold in each sheet so as to increase its resistance to deformation out of a horizontal plane when the sheet falls in the frame.

25

3. A method as claimed in Claim 1 or Claim 2, further including the steps of allowing the glue to dry in the stacked sheets and then guillotining the sheets.

30

4. A method as claimed in any one of the preceding claims, wherein the sheets which are transported to the glue applicator are taken from a printing press as part of a continuous process.

35

5. Apparatus for manufacturing a book from a plurality of sheets, which apparatus comprises:

- 5 a) means for applying glue to at least one pre-selected area of the top surface of a sheet;
- b) a frame for receiving and stacking the sheets, the frame having an opening through which a sheet may enter, and at least one end stop for checking the forward movement of the sheets, the frame being
10 internally dimensioned so that each sheet is a close fit inside the frame when aligned generally horizontally;
- c) means for transporting each sheet to the glue applicator;
- 15 d) means for aligning each sheet in register with the opening of the frame;
- e) means for transporting each sheet from the glue applicator through the opening and into the frame; and
- 20 f) means for knocking the sheets towards the end stop as they fall in the frame so that the sheets stack in register with one another.

6. Apparatus as claimed in Claim 5, which is provided
25 with means for folding sheets before they are stacked in the frame.

7. Apparatus as claimed in Claim 5 or Claim 6, which is provided with height adjusting means for raising and
30 lowering the frame.

8. Apparatus as claimed in Claim 7, wherein the height adjusting means comprises an inflatable airbag which supports the frame.

9. Apparatus as claimed in any one of Claims 5 to 8, wherein the internal dimensions of the frame are adjustable to accommodate different sizes of sheets.

5 10. Apparatus as claimed in Claim 8 or Claim 9, wherein the glue applicator is one or more non-contact glue guns which are pneumatically operated.

10 11. Apparatus as claimed in Claim 10, wherein the same air source is used to pressurise the glue guns as is used to inflate the airbag.

15 12. Apparatus as claimed in any one of Claims 5 to 11, further including programmable means for preventing the application of glue to every nth sheet, where n is the number of sheets which are to make up the book.

20 13. Apparatus for manufacturing a book from a plurality of sheets substantially as herein described with reference to and as shown in any one of the Figures of the drawing.

14. A method of manufacturing a book from a plurality of printed sheets substantially as herein described with reference to any one of the Figures of the drawing.

15

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

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Relevant Technical Fields

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(ii) Int Cl (Ed.6) B42C: 1/00, 1/12, 9/00, 9/02, 19/00, 19/02, 19/08

Date of completion of Search
 27 SEPTEMBER 1995

Databases (see below)

(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

Documents considered relevant following a search in respect of Claims :-
 1-12

(ii) ONLINE DATABASE: WPI

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Category	Identity of document and relevant passages	Relevant to claim(s)
Y	US 4540458 (KODAK) see column 2, lines 3-20, column 6, lines 31-40, column 15, line 56 to column 16, line 45 and column 21, line 1 to column 22, line 15	1 at least
Y	US 4511297 (KODAK) see column 2, lines 63-68 and column 4, lines 35-55	1 at least

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